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show a periodicity in their starch content which coincides with the recurrence of daylight and darkness, that locally darkened areas of the leaf blade soon show a deficiency in starch content, and that when the stomata are closed with cocoa butter starch formation does not occur. Further it appears that shoots free from starch soon showed the presence of that substance if placed in sunlight in an atmosphere containing CO_2, but controls, also in sunlight but in an atmosphere without CO_2, showed no starch. Support is also given to the contention that many of these plants receive no carbohydrates from their hosts by the fact that they will thrive as root parasites upon annuals which have no starch or sugar stored in their subterranean organs.—GEO. D. FULLER.

Phosphorescence in plants

MOLISCH[4] has issued a second and enlarged edition of his work on phosphorescing plants. The book is very simply and interestingly written, and brings up to date his own extensive work in this field as well as the work of all other investigators. The first chapter answers negatively the question "are there phosphorescing algae?", and shows that such appearances are due to light reflection or to animals living on the algae. The second chapter gives the evidence for the existence of phosphorescence in marine Peridineae and for its absence in fresh water forms. The third chapter deals at length with the phenomenon in fungi, both Hyphomycetes and bacteria, and the fourth shows the relation of salts and temperature to the light production in bacteria. The fifth treats of the nutrition, phosphorescing, and growth of the light-producing fungi, and the sixth with the manner in which light is produced. Phosphorescence is an oxidation process demanding a minimal though very small partial pressure of oxygen. There is no convincing evidence for any direct relation between respiration and phosphorescence, much less for the latter being produced by the former. The living cell produces a substance, photogen, which phosphoresces in the presence of water and free oxygen. In the higher fungi and bacteria, in contrast to many animals, the phosphorescing has never been obtained extracellularly. In chapter seven the author gives the spectra and other characters of the light produced by various fungi.

The bacterial light is of sufficient intensity and of proper quality to render photographic work possible by it as the sole source of light. It will cause heliotropic response in various seedlings and fungi, and lead to chlorophyll production, detectable by the spectroscope though not sufficient for visible greening. The light is not capable of penetrating opaque objects, as some workers have probably wrongly claimed for light produced by various animals.

In contrast to the situation with many animals, MOLISCH cannot discover any biological significance of light production in plants. The last chapter deals with the alleged phosphorescence in flowering plants, and concludes that the cases cited are either counterfeit or due to electrical phenomena (St. Elmo's fire).—WILLIAM CROCKER.

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[4] MOLISCH, HANS, Leuchtende Pflanzen, eine physiologische Studie. viii+193. *pls. 2. figs. 18.* Jena: Gustav Fischer. 1912.

MINOR NOTICES

The nuclei of Protista.—The name "Protista," applied by HAECKER to the lowest animals and plants, has failed to receive general acceptance, even among zoologists, and the forms are found under both the protozoa and unicellular plants. In any consideration of the phylogeny of the nucleus these forms must be of great interest, because the nuclei of the metazoa and of the higher algae and fungi are too highly differentiated to throw much light upon such a subject as the origin of the nucleus. A paper by HARTMAN[5] deals almost entirely with the nucleus of protozoa and its significance as the forerunner of the nucleus of the metazoa. Botanists working with the nucleus in the lower algae and fungi, and especially with flagellates, cannot afford to overlook this paper.—CHARLES J. CHAMBERLAIN.

Symbolae Antillanae.[6]—In continuation of this important work Professor URBAN in cooperation with several eminent specialists has issued the second and third fascicles of the seventh volume. There are included descriptions of approximately 300 new species, several varieties, and a few new combinations. The following new genera are proposed: *Sarcopilea* of the Urticaceae, *Plethadenia* of the Rutaceae, *Hypocoton* of the Euphorbiaceae, *Ottoschulzia* of the Icacinaceae, *Maga* of the Malvaceae, *Poicillopsis* of the Asclepiadaceae, *Tuerckheimocharis* of the Scrophulariaceae, and *Shaferocharis* of the Rubiaceae.—J. M. GREENMAN.

NOTES FOR STUDENTS

Root-tubercles of non-leguminous plants.—In an extremely long and somewhat obscure article, which is not made any clearer by the vague illustrations accompanying it, PEKLO[7] gives an account of his studies of the organisms in the root-tubercles of *Alnus* and *Myrica.* With respect to the morphology of the organisms the author adds nothing to what is known from earlier accounts, especially the excellent account of SHIBATA with which he agrees in all essential details. PEKLO finds in the cells of the root-swellings of *Alnus* and *Myrica* masses of filaments with more or less radial arrangement and termi-

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[5] HARTMAN, MAX, Die Konstitution der Protistenkerne und ihre Bedeutung für die Zellenlehre. 8vo. pp. v+54. *figs. 13.* Jena: Gustav Fischer. 1911.

[6] URBAN, I., Symbolae Antillanae seu fundamenta florae Indiae Occidentalis. Vol. VII, fasc. 2, pp. 161–304, 15 June; fasc. 3, pp. 305–432, 1 October. Leipzig: Fratres Borntraeger. 1912.

[7] PEKLO, J., Die pflanzlichen Aktimonykosen. Centralbl. Bakt. II. **27**:451–579. 1910.